AIM
Solder plus Support

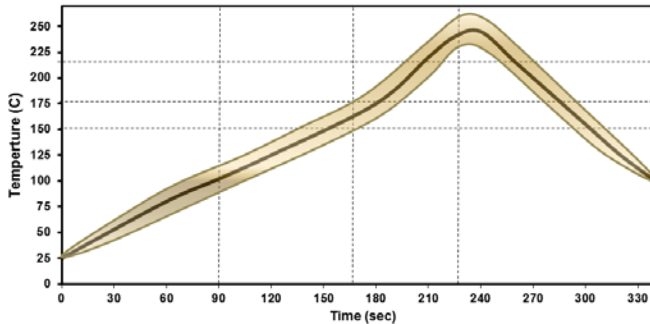
LEAD-FREE ALLOYS

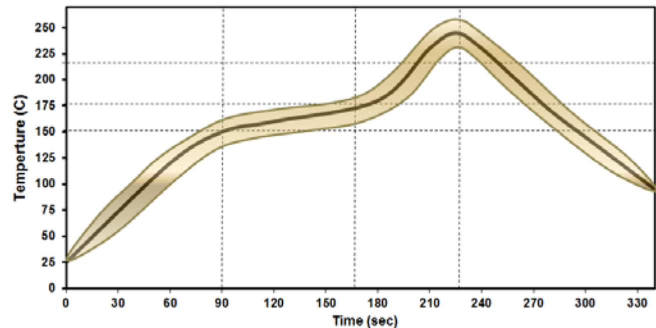
REFLOW PROFILE GUIDELINES

The information provided is a guideline only. Your profile will depend upon many factors including paste chemistry, customer requirements, component limitations, oven characteristics, board layout, etc. Ultimately, quality requirements should drive the process, not adherence to these guidelines.

Ideally, profile measurements are to be collected on a populated assembly with the reflow profile recorded for each assembly being processed. It is common for the same profile settings to be used for multiple assemblies. Reflow profile data should be collected, analyzed and recorded for each assembly part number at the beginning of individual production runs. Profile modifications are more precise when oven zone settings are adjusted rather than belt speed /profile length.

There are two basic profile types: Ramp-Soak-Spike (RSS) and Ramp-To-Spike (RTS). RTS profiles are suitable for use in most applications for enhanced solder performance. RSS profiles are appropriate when the assembly has a large thermal mass or large ΔT.





Typical **RTS** Profile
Profile Length: 3.5/4.5 minutes
Ramp Rate: 1.5-3°C/sec. to 240°C ± 15°C
Time above Liquidus: 45 seconds ± 15 seconds
Peak Temperature: 235-260°C
Cool Down Rate: 4°C per second MAX

Typical **RSS** Profile
Profile Length: 3.5/4.5 minutes
Preheat: 2-3°C/sec. for 60-90 seconds
Soak: 150-170°C for 45-75 seconds
Time above Liquidus: 45 seconds ± 15 seconds
Peak Temperature: 235-260°C
Cool Down Rate: 4°C per second MAX

Contact AIM Technical Staff for Profiling Assistance and Process Support

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PROFILE TROUBLESHOOTING

Void Reduction

Solder paste is approximately 50% flux by volume and not all of this flux can be evacuated from the solder joint during reflow. Profiling techniques can be used to reduce void formation with modest improvements. Other process variables may have more significant impact.

Typical Void Reduction Profile
Profile Length: 4/4.5 minutes
Ramp: 2-3°C/sec for 60 seconds
Standard Soak: 150-170°C for 90-120 seconds
1. High Soak: 190-200°C for 60-120 seconds
2. Low Soak: 120-140°C for 60-120 seconds
Spike to Peak: 1.5-2°C per second to 235-260°C
Time above Liquidus: 45 sec ±15
Peak: 235-260°C
Cool Down Rate: 4°C per second MAX

BGA Head-in-Pillow (HiP) Reduction

This profile will help reduce the effects of warpage of plastic BGA packages that leads to HiP defects and may require peak temperature in penultimate heating zone.

Typical HiP Reduction Profile
Profile Length: 4/4.5 minutes
Ramp: 2-3°C/sec for 60 seconds
Soak: 150-170°C for 90-120 seconds
Spike to Peak: 1-1.5°C per second to 235-260°C
Peak: 235-260°C
HiP Cool-Down Soak: 240-220°C for 15-25 seconds
Time above Liquidus: ≥60 seconds
Cool Down Rate: 4°C per second MAX

Wetting Improvement

Wetting issues, whether component or substrate can be improved through profiling. If the wetting issue is global, it can often be improved with proper profiling technique. If the wetting issue is component specific, it is likely a plating issue with the component/substrate. Profiling can be manipulated to improve wetting, but may affect other devices on the assembly. A general approach is to shorten the profile to as little as three (3) minutes and to increase the peak temperature by 10-15°C.

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TROUBLESHOOTING

Issue	Possible Cause											
	Preheat Rate Is Too High	Preheat Rate Is Too Low	Soak Zone Too Long or Too High	Soak Zone Too Short or Too Cool	Excessive Time Above Liquidus (TAL)	Insufficient Time Above Liquidus (TAL)	Peak Temp Too High	Peak Temp Too Low	Cooling Rate Too Fast	Cooling Rate Too Slow	Profile Too Long	Profile Too Short
Dark residue	✓						✓					
Brittle solder joints						✓		✓			✓	✓
Frosty solder joint										✓		
Component deformation/ damage							✓					
Crazing of residue									✓			
De-wetting	✓		✓		✓		✓					
Joints/visible solder spheres						✓					✓	✓
Grainy solder joints	✓		✓		✓		✓	✓		✓	✓	✓
Excess residue						✓		✓				✓
Flux/solder paste spatter	✓											
Malleable/ weak solder joint					✓					✓		
Poor or non-wetting						✓		✓			✓	✓
Popcorning/ component damage	✓											
Solder balls/solder beads		✓										
Thermal shock/ component damage									✓			
Tombstoning			✓	✓					✓			
Voiding						✓		✓				

This defect information is specific to potential causes that are reflow profile related. Soldering defects can be caused by a myriad of other process/material variables. Please consult AIM Technical Support for targeted process and profiling assistance.

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